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(54) Title: HAIR STYLING COMPOSITIONS PROVIDING IMPROVED HAIR VOLUME AND HAIR HOLD PERFORMANCE

(57) Abstract

Disclosed are hair styling compositions which provide improved hair volume and hair hold performance, and which provide for a DRY HAIR INDEX of at least 242 after application and drying of the compositions on dry hair. These air styling compositions comprise from about 12 % to about 90 % by weight of a polyalkylene glycol styling agent that is substantially free of polyalkylene glyceryl ethers, and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and from about 1 % to about 88 % by weight of a liquid carrier which can be water, an organic solvent, or combinations thereof. Also disclosed are hair styling compositions in the form of pomades which provide improved hair volume and hair hold performance, and which comprise from about 65 % to about 99 % by weight of the select polyalkylene glycol styling agent, and from about 1 % to about 30 % by weight of a liquid carrier.

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Hair Styling Compositions Providing Improved Hair Volume and Hair Hold Performance

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FIELD OF INVENTION

The present invention relates to hair styling compositions which provide improved hair volume and hair hold performance. In particular, the present invention relates to hair styling compositions which leave a polyalkylene glycol-containing residue on dry hair that provides for a DRY HAIR INDEX of at least 242.

BACKGROUND OF THE INVENTION

Hair styling compositions are well known and are commercially available in a variety of forms including mousses, gels, lotions, pumps, or hairsprays. Many of these products contain various hair styling agents to provide temporary hair styling benefits such as body, hold, luster, improved hair feel, and good style retention.

Within this product group, hairsprays have become especially popular among consumers as an effective means for styling or "setting" the hair. The hairspray compositions typically comprise gums or resins styling agents to provide for good style retention and hair feel benefits. Most of the hairsprays, however, are sprayed onto the hair after the hair is styled in order to temporarily secure the desired hair style.

One method of providing temporary hair styling benefits from a styling product while styling the hair involves the use of a hair mousse. Many hair mousse products have been formulated such that the hair mousse composition can be applied to wet or damp hair before styling or "setting" the hair. Typically, the hair mousse compositions are aqueous formulations which contain water-soluble styling agents that provide adhesive properties to the hair while the hair is wet and being styled. These styling agents, however, can form hard breakable films on the hair as the styling process is near completion, and this can result in an unacceptable hair style or in a hair style that cannot be restyled unless additional water and/or supplemental styling products are added to the hair. Moreover, the use of aqueous hair mousse compositions which contain water-soluble styling agents can leave the hair feeling unduly sticky and stiff.

One attempt at producing an aqueous hair mousse composition that is especially effective in providing good hair styling performance without leaving the hair feeling unduly stiff or sticky involves the formulation of an aqueous hair mousse which comprises a water-soluble styling polymer, a silicone emulsion, a liquid carrier comprising a combination of water and lower alcohols, and a silicone-linear polyoxyalkylene block copolymer surfactant which maintains stability of the silicone emulsion. Although

these aqueous hair mousse compositions are effective in providing good hair styling performance and improved hair feel, they are also typically applied to wet or damp hair, and often lead to the application of an additional styling product once the hair has dried in order to achieve the desired final hairstyle form.

Another attempt at producing an aqueous aerosol hair mousse composition that provides good hair styling performance and improved hair feel involves the use of a combination of panthenol and certain low molecular weight polyalkylene glycols. The low molecular weight polyalkylene glycols, i.e., polyethylene glycols or polypropylene glycols having from 3 to about 12 ethylene glycol or propylene glycol units, help to effectively and efficiently deliver the panthenol to the hair. These hair mousse compositions, however, are also typically applied to wet or damp hair to achieve the desired hair conditioning benefits and generally require reapplication of the composition or another styling product to maintain or modify the original hairstyle.

Therefore, a need exists for hair styling compositions which provide for a desired hair style to be achieved and maintained, and which can be applied or sprayed on the hair during the styling process. A recent method of making a hair styling composition that can be applied to wet and/or dry hair during the styling process, and provide improved styling performance is described in JP 8-346608, published June 23, 1998. The hair styling compositions disclosed in this publication contain polyalkylene glyceryl ethers styling agents to provide for sustained hair styling performance and improved aesthetics such as longer moisture and luster to the hair. These polyalkylene glyceryl ether styling agents typically do not readily penetrate into the hair and can remain on the hair fibers to provide the improved hair styling benefits. The polyalkylene glyceryl ether containing compositions disclosed in this particular publication, however, tend to provide minimal or no hold to the hair, and this can result in poor style achievement and poor style retention performance.

Another recent method of making a hair styling composition that can be applied during the styling process, and provide improved styling performance is described in WO 98/38969, published September 11, 1998. The compositions disclosed in this publication use certain styling agents which deliver hair style performance to dry hair, and provide for the dry hair to be restyled without having to reapply the composition and without requiring the use of another styling product. The styling agents described in this reference include anionic, cationic, amphoteric, and nonionic styling polymers, preferably sulfonated anionic styling polymers which have an average molecular weight of from about 500 to about 5,000,000. These styling agents, however, have exceptional cohesive strength which provides for the hair fibers to be firmly held together, and this can cause the dry hair to feel coarse and be difficult to comb, style, and restyle.

It has been found that other hair styling compositions, particularly aerosol hair styling compositions, can be formulated to provide improved dry hair styling and restyling performance for extended periods of several days without the need to reapply the composition and/or add any other styling aids. Unlike the compositions described in the WO 98/38969 publication, these aerosol hair styling compositions comprise low molecular weight polyalkylene glycol styling agents that are liquids or

semisolids under ambient conditions and that can remain as a liquid or semisolid after the compositions have been applied and allowed to dry on the hair. The ability of these select polyalkylene glycol styling agents to remain as a liquid or semisolid provides for improved dry hair aesthetics such as smooth and easily styled hair in addition to the improved restyling performance.

5 It has now been found that hair styling compositions, especially aqueous hair styling compositions, which comprise select low molecular weight polyalkylene glycol styling agents can provide not only improved dry hair feel and styling performance, but also provide for improved hair volume and hair hold performance. These compositions provide certain properties as defined by a DRY HAIR INDEX, and are particularly useful for providing superior hair volume and hair hold performance. The hair styling
10 compositions of the present invention, when evaluated on dry hair, provides for the dry hair to exhibit hair volume and hair hold values such that $(20 \times \text{Hair Volume Index}) + \text{Hair Hold Index} = \text{at least } 242$.

It is therefore an object of the present invention to provide an aqueous hair styling composition which provides improved hair volume and hair hold performance, and which leaves a polyalkylene glycol-containing residue on dry hair that provides for a DRY HAIR INDEX of at least 242. It is also an object of
15 the present invention to provide a non-aqueous hair styling composition which provides improved hair volume and hair hold performance, and which leaves a polyalkylene glycol-containing residue on dry hair that provides for a DRY HAIR INDEX of at least 266. It is yet another object of the present invention to provide a hair styling composition in the form of a hair mousse which provides improved hair volume and hair hold performance, and which leaves a polyalkylene glycol-containing residue on dry hair that provides
20 for a DRY HAIR INDEX of at least 242. It is still yet another object of the present invention to provide a hair styling composition which provides for a DRY HAIR INDEX of at least 242, and further which provides for improved dry hair restyling performance and improved hair feel for extended periods of time without the need to reapply the composition or add any other styling aids.

25

SUMMARY OF THE INVENTION

The present invention is directed to aqueous hair styling compositions which comprise (a) from about 12% to about 90% by weight of a polyalkylene glycol that is substantially free of polyalkylene
30 glyceryl ethers and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and (b) from about 1% to about 88% by weight of water; wherein after application and drying of the composition on dry hair the composition provides for a DRY HAIR INDEX of at least 242.

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The present invention is also directed to non-aqueous hair styling compositions which comprise from about 12% to about 90% by weight of a polyalkylene glycol that is substantially free of polyalkylene

glyceryl ethers and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and (b) from about 1% to about 88% by weight of a non-aqueous liquid carrier; wherein after application and drying of the composition on dry hair the composition provides for a
5 DRY HAIR INDEX of at least 266.

The present invention is also directed to a hair mousse composition which comprises from about 12% to about 90% by weight of a polyalkylene glycol that is substantially free of polyalkylene glyceryl ethers and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2
10 to 6 carbon atoms; and (b) from about 1% to about 88% by weight of a liquid carrier; wherein after application and drying of the composition on dry hair the composition provides for a DRY HAIR INDEX of at least 242.

The present invention is also directed to hair styling compositions which comprise (a) from about 65% to about 99% by weight of a polyalkylene glycol that is substantially free of polyalkylene glyceryl ethers and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2
15 to 6 carbon atoms; and (b) from about 1% to about 30% by weight of a liquid carrier; wherein after application and drying of the composition on dry hair the composition provides for a DRY HAIR INDEX of at least 242.

20 It has been found that hair styling compositions which comprise select low molecular weight polyalkylene glycol styling agents can provide for improved hair volume and hair hold performance. These compositions provide certain properties as defined by a DRY HAIR INDEX such that when the compositions are evaluated on dry hair, the dry hair exhibit hair volume and hair hold values that can be expressed as $(20 \times \text{Hair Volume Index}) + \text{Hair Hold Index} = \text{at least } 242$.

25

DETAILED DESCRIPTION OF THE INVENTION

The hair styling compositions of the present invention comprise select polyalkylene glycols that
30 can be deposited on the hair and form reformable welds on the hair fibers which provide for improved hair volume and hair hold performance. These compositions are intended for application to dry hair, and are preferably formulated as leave-on hair styling products.

The term "leave-on" as used herein refers to compositions that contain ingredients that are intended to be deposited and left on the hair for extended periods (e.g. several hours or days) until the ingredients are
35 subsequently removed by water and/or by shampooing the hair.

The term "reformable weld" as used herein refers to residues which are left on dry hair and which contain materials that are liquid or semisolid at ambient condition, and that can remain as a liquid or semisolid after the compositions described herein have been applied and allowed to dry on the hair.

5 The term "ambient conditions" as used herein refers to surrounding conditions at about one atmosphere of pressure, at about 50% relative humidity, and at about 25°C.

The term "substantially free" as used herein, unless otherwise specified, refers to preferred negative limitations of the compositions of the present invention, and are directed to the amount and concentration of polyalkylene glyceryl ether styling agents, or derivatives thereof, in the compositions. The term "substantially free" means that the compositions preferably contain less than an effective amount of such agents when used alone to provide any hair styling performance when the compositions are applied to the hair. In this context, the negative limitations pertain only to those polyalkylene glyceryl ether styling agents which are also a liquid or semisolid under ambient conditions, and which are not silicone-containing materials. Generally, the compositions preferably contain less than 5%, more preferably less than 2%, even more preferably less than 1%, most preferably zero percent, of such agents by weight of the compositions.

15 The hair styling compositions of the present invention can comprise, consist of, or consist essentially of the essential elements and limitations of the invention described herein, as well as any of the additional or optional ingredients, components, or limitations described herein.

All percentages, parts and ratios are by weight of the total composition, unless otherwise specified. All such weights as they pertain to listed ingredients are based on the active level and, therefore, do not include solvents or by-products that may be included in commercially available materials, unless otherwise specified.

Styling Agent

25 The hair styling compositions of the present invention comprise a liquid or semisolid hair styling agent suitable for being left on dry hair as a liquid or semisolid after the composition has been applied and allowed to dry on the hair. These hair styling agents provide for a fluid film to be left on the hair which can be characterized as a reformable weld that provides unproved hair volume and hair hold performance.

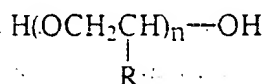
30 The concentration of the styling agent may vary with each selected hair styling formulation, but such concentrations will generally range from about 12% to about 90%, preferably from about 12% to about 75%, more preferably from about 15% to about 50%, even more preferably from about 15% to about 25%, by weight of the composition. For hair styling compositions in the form of a pomade product, the concentration of the styling agent preferably ranges from about 65% to about 99%, more preferably from about 65% to about 95%, even more preferably from about 65% to about 90%, by weight of the composition.

35 Suitable styling agents for use in the hair styling compositions of the present invention include any known or otherwise effective hair styling agents, other than polyalkylene glyceryl ethers, that are liquids or

semisolids under ambient conditions and that can remain a liquid or semisolid after the composition has been applied and allowed to dry on dry hair. It has been found that certain liquid or semisolid styling agents, particularly low molecular weight polyalkylene glycols, can provide for a fluid film to be left on the hair that provides for improved dry hair feel properties, and improved hair volume and hair hold performance.

Nonlimiting examples of styling agents suitable for use in the hair styling compositions of the present invention include polyalkylene glycols, polyethylene/polypropylene glycol copolymers, polyethylene/polypropylene diol copolymers, polyglycerins, and mixtures thereof, and/or their derivatives, and/or mixtures thereof, excluding the polyalkylene glyceryl ethers which are also liquids or semisolids under ambient conditions.

Preferred styling agents suitable for use herein include those polyalkylene glycols which conform to the formula:



wherein R is selected from the group consisting of H, methyl, and mixtures thereof. When R is H, these materials are polymers of ethylene oxide, which are also known as polyethylene oxides, polyoxyethylenes, and polyethylene glycols. When R is methyl, these materials are polymers of propylene oxide, which are also known as polypropylene oxides, polyoxypropylenes, and polypropylene glycols. When R is methyl, it is also understood that various positional isomers of the resulting polymers can exist.

In the above structure, n has an average value of from 4 to about 35, preferably from about 5 to about 35, more preferably from about 5 to about 30, and even more preferably from about 5 to about 20.

Specific examples of preferred polyalkylene glycol polymers include polyethylene/polypropylene glycol copolymers (e.g., methoxy, ethoxy, propoxy, butoxy, and pentoxy, polyethylene/polypropylene glycols), triglycerin, hexaglycerin, PPG-4, PPG-6, PEG-5, PEG-6, PEG-8, PEG-12, PEG-14, PEG-18, PEG-20, PEG-32, and mixtures thereof. Most preferred are those polyalkylene glycols which have a number average molecular weight of from about 190 to about 1500, preferably from about 300 to about 1200, more preferably from about 400 to about 1000; and from about 5 to about 35, preferably from about 5 to about 30, more preferably from about 5 to about 20, repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms. Specific examples of the most preferred polyalkylene glycols include, but are not limited to, PPG-4 wherein R equals methyl and n has an average value of about 4; PEG-8 wherein R equals H and n has an average value of about 8 (PEG-8 is also known as Carbowax 400, which is available from Union Carbide); PEG-12 wherein R equals H and n has an average value of about 12 (PEG-12 is also known as Carbowax 600, which is available from Union Carbide); and PEG-20 wherein R equals H and n has an average value of about 20 (PEG-20 is also known as Carbowax 900 which is available from Union Carbide).

In addition to the styling agent, the hair styling compositions of the present invention may further comprise one or more optional styling polymers which can help provide improved initial hair hold performance. The total concentration of such optional styling polymers ranges from about 0.25% to about 5%, preferably from about 0.5% to about 2.5%, by weight of the compositions.

5 Optional styling polymers for use in combination with the styling agent defined herein include any known or otherwise effective styling polymer, provided that the optional styling polymer is soluble in the liquid carrier described herein which contains the optional styling polymer and styling agent, and provided that under test conditions of 27°C and 15% relative humidity the optional styling polymer is insoluble in the residue described herein and can form a solid film that is surrounded by the styling agent material after
10 evaporation of the liquid carrier and any other volatile materials contained in the hair styling compositions of the present invention. Such optional styling polymers include, but are not limited to, polysaccharide styling polymers. Specific nonlimiting examples of suitable polysaccharide styling polymers include anionic polysaccharides, cationic polysaccharides, and glucosamine polysaccharide derivatives. The glucosamine polysaccharide derivatives are the preferred optional styling polymers.

15 Suitable optional cationic polysaccharide styling polymers for use herein include, but are not limited to, copolymers of hydroxyethylcellulose and diallyldimethyl ammonium chloride (referred to in the industry by CTFA as Polyquaternium-4) such as those commercially available from National Starch (Bridgewater, New Jersey) under the CELQUAT tradename (e.g., CELQUAT L-200 and CELQUAT H-100); and cationic quaternary ammonium-containing polymers, including, for example, homopolymers of
20 hydroxyethyl cellulose reacted with a trimethyl ammonium substituted epoxide, (referred to in the industry by CTFA as Polyquaternium-10) such as those commercially available from Amerchol Corp. (Edison, New Jersey) under the UCARE tradename (e.g. UCARE POLYMER JR-400, and UCARE POLYMER LR-400), and those commercially available from National Starch (Bridgewater, New Jersey) under the CELQUAT tradename (e.g., CELQUAT SC 230 and CELQUAT SC 240).

25 Optional preferred polysaccharide styling polymers for use in combination with the styling agent in the hair styling compositions of the present invention include those polysaccharide styling polymers which are derived from chitin, a glucosamine polysaccharide that is extracted from the shells of crabs, lobsters, and the like. An example of the use of chitin to make a chitin derivative for use in the compositions herein is the preparation of Chitosan, a water-soluble chitin derivative that is prepared by the known process of
30 deacylation of the chitin compound. The chitin derivatives can also be prepared by other methods well known in the art for the preparation of such materials, including the hydroxypropylation of the chitin compound. The chitin derivatives suitable for use as an optional styling polymer herein include those chitin derivatives which are commercially available in a neutralized or unneutralized form. In the event that a neutralized chitin derivative is used, suitable neutralizing agents include, but are not limited to, lactic acid,
35 pyrrolidone carboxylic acid, and glycolic acid.

Specific examples of preferred chitin derivatives for use as an optional styling polymer include, but are not limited to, Kytamer L and Kytamer PC (both are neutralized Chitosan materials commercially available from the Amerchol Corp., located in Edison, New Jersey); and Hydagen HCMF molecular weight (MW) of 50,000 to 1,000,000, Hydagen DCMF MW of 300,000 to 2,000,000, and Hydagen CMFP MW of 500,000 to 5,000,000 (all are unneutralized Chitosan materials commercially available from the Henkel Corp., located in Hoboken, New Jersey). Kytamer L is the most preferred chitin derivative.

Liquid Carrier

The hair styling compositions of the present invention comprise any known or otherwise effective liquid carrier that is suitable for use in hair styling formulations intended for topical application to human hair or skin. The liquid carrier helps to solubilize or disperse the styling agents described hereinbefore. The liquid carrier can comprise one or more liquid carriers provided that the selected styling agent is sufficiently miscible or dispersible in the selected liquid carrier.

The total concentration of the liquid carrier in the composition will vary with the type of liquid carrier selected, the type of styling agent used in combination with the liquid carrier, and the solubility of the selected styling agent in the selected liquid carrier, and so forth. Preferred total concentration of the liquid carrier ranges from about 1% to about 88%, preferably from about 3% to about 88%, more preferably from about 5% to about 85%, by weight of the composition.

Suitable liquid carriers for use in the hair styling compositions of the present invention include volatile liquid carrier materials. In this context, the term "volatile" refers to materials which have a boiling point of less than about 260°C, preferably from about 50°C to about 260°C, more preferably from about 60°C to about 200°C (at about one atmosphere of pressure).

Nonlimiting examples of volatile liquid carriers include water; organic solvents such as C₁-C₆ alkanols, carbitol, and acetone; and combinations thereof. Specific examples of suitable C₁-C₆ alkanols include, but are not limited to, ethanol, n-propanol, isopropanol, n-butanol, amyl alcohol, and mixtures thereof. Preferred C₁-C₆ alkanols include C₂-C₄ monohydric alcohols such as ethanol, isopropanol, and mixtures thereof.

In the event that the hair styling compositions of the present invention comprise combinations of water and an organic solvent such as C₁-C₆ alkanols, water is preferably included at concentrations of from about 40% to about 88%, more preferably from about 50% to about 88%, even more preferably from about 60% to about 88%; and the C₁-C₆ alkanols are preferably included at total concentrations of from about 1% to about 15%, more preferably from about 3% to about 15%, even more preferably from about 5% to about 10%, by weight of the composition.

Properties of the Hair Styling Compositions

The hair styling compositions of the present invention, when evaluated on dry hair, provide for specific hair volume and hair hold values as defined by the DRY HAIR INDEX which is determined as described hereinbelow. It has been found that hair styling compositions which exhibit the DRY HAIR INDEX properties defined herein are especially effective in providing improved hair volume and hair hold performance. The DRY HAIR INDEX is determined by the expression $(20 \times \text{Hair Volume Index}) + \text{Hair Hold Index} = \text{at least } 242$. The hair styling compositions of the present invention are characterized by providing for a DRY HAIR INDEX of at least 242, preferably from 242 to about 600, more preferably from 266 to about 600, and even more preferably from 280 to about 600.

10 **Methodology for determining DRY HAIR INDEX:**

The DRY HAIR INDEX as described above can be determined or otherwise characterized, when the compositions of the present invention are evaluated on dry hair, by the following expressions:

- 15 i) $20x - y = 242$
ii) $20x + y = 266$
iii) $20x - y = 280$

wherein x is the Hair Volume Index, and y is the Hair Hold Index.

20 The Hair Volume Index is defined as the mean hair volume value for each test product indexed to three controls. In this context, the term "indexed" means that dry hair switches which have been treated with a hair styling composition of the present invention are visually evaluated for hair volume using a scale of 0 to 10, based on the visual reference of three control dry hair switches which are assigned respective hair volume values of 0, 5, and 10. The three control switches which are used as visual reference switches in the procedure for determining the Hair Volume Index include (1) an untreated dry hair switch with an assigned hair volume value of 0, (2) a dry hair switch which has been treated with Control Product A (described in detail hereinafter), and which has an assigned hair volume value of 5; and (3) a dry hair switch which has been treated with Control Product B (described in detail hereinafter), and which has an assigned hair volume value of 10.

25 The Hair Hold Index is predicted by measuring the hair hold values of dry hair switches which have been treated with the hair styling compositions of the present invention, and indexing these measured values to that of two control dry hair switches which are assigned respective hair hold values of 0 and 100. The two control switches which are used in the procedure for determining the Hair Hold Index include (1) a dry hair switch which has been treated with Control Product A (described in detail hereinafter), and which has an assigned hair hold value of 100; and (2) a dry hair switch which has been treated with Control Product B (described in detail hereinafter), and which has an assigned hair hold value of 0.

30 The procedures for the determination of the Hair Volume Index and the Hair Hold Index are described in detail hereinbelow.

a) **Control shampoo product:**

In preparation for control and test product application on hair switches which are used in the procedure for the determination of the Hair Volume Index, the hair switches are pre-treated with a control shampoo product. After treatment with the control shampoo product, and before application of the control or test product, the hair switches are allowed to dry in a temperature/humidity control room having 24°C/50% relative humidity (hereinafter RH). The control shampoo product is prepared using conventional formulation and mixing techniques for formulating shampoo compositions. The control shampoo product has the following formulation:

Control Shampoo Product

Component	Weight %
Ammonium Laureth-3-Sulfate	51.24
Ammonium Lauryl-Sulfate	36.38
Ammonium Xylenesulfonate (50%)	3.50
Cocamide-DEA	2.30
Perfume	0.50
Distilled water	qs

The treatment process for application of the control shampoo product on the hair switches include wetting the hair switches with tap water for 30 seconds, followed by applying 2.0 cc of the control shampoo product to each hair switch. The hair switches are then lathered for 30 seconds, followed by rinsing each hair switch with tap water for 60 seconds. After rinsing, the excess water is squeezed from each hair switch by running the index and middle fingers along the length of the switch with firm pressure. The hair switches are then combed through once with a beautician's comb. The hair switches are then dried by hanging the switches in a hot box for 3 hours at 60°C. In preparation for control and test product application, the dry hair switches are then hung on a bar in a 24°C/50% RH control room. A total of ten switches are treated in preparation for application of the control and suitable test product formulations which are used in the procedure for the determination of the Hair Volume Index.

Additionally, all water used to rinse the shampoo control product, the control products, and any test products from the hair switches is 39°C tap water with a grain of 7 to 11 and a flow rate of 1.5 gallons per minute. Also, care is taken to avoid contamination of a given product with another (e.g., by wearing clean gloves).

b) Control hair styling products:

The following hair styling formulations are used as the control products which are applied to the hair switches referred to herein as the control dry hair switches. The control dry hair switches are used as the reference switches in the evaluation procedures for determining the Hair Volume Index and Hair Hold Index values.

The control hair styling products are each prepared by combining all of the respective listed components, except the propellant, and mixing the combination for 40 minutes to ensure a homogenous

composition. The resultant homogenous liquid mixture is then filled into an aerosol container, and the propellant is added. For Hair Volume Index evaluations, the control dry hair switches are treated with 6 grams of the respective control product. For Hair Hold Index evaluations, the control dry hair switches are treated with 1.13 grams of the respective control product. The control hair styling products have the following formulations:

Control Product A

Component	Weight %
PVP/VA, 60/40 (50% active)	8.10
Glycerin	4.80
Ethanol, denatured	1.20
Propylene glycol	0.27
Cocamide DEA (87% active)	0.14
Nonoxynol-12	0.14
Kytamer L	0.045
Propellant, Aeron A-46	10.00
Distilled water	qs

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Control Product B

Component	Weight %
PEG-8	9.0
Glycerin	4.50
60% silicone emulsion, DC 2-1559	4.50
Steartrimonium Chloride	0.27
PEG-60 Castor Oil	0.18
Propellant, Aeron A-46	10.0
Distilled water	qs

15

c) Hair Volume Index:

The hair volume value of a dry hair switch, which is used in the determination of the Hair Volume Index, is determined by having panelists visually evaluate a dry hair switch which has been treated with a composition of the present invention for hair volume attribute using a scale of 0 to 10, wherein 0 is "most volume" and 10 is "least volume." The dry hair switches are evaluated by visually comparing the volume attribute of each switch relative to three control switches which have been assigned a hair volume value of 0, 5, or 10. The dry hair control switch which has been untreated is identified as the visual control for each volume attribute with an assigned value of 0. The dry hair control switch which has been treated with Control Product A is identified as the visual control for each volume attribute with an assigned value of 5. The dry hair control switch which has been treated with Control Product B is identified as the visual control for each volume attribute with an assigned value of 10.

The dry hair switches used in the procedure for the determination of the Hair Volume Index are 60 gram/25.4 centimeters (cm) long Asian ponytail hair switches supplied by Advanced Testing Laboratories located in Cincinnati, Ohio.

In preparation for control and test product application, the switches are kept hanging on a bar in a temperature/humidity control room having 24°C/50% RH. For hair styling compositions in the form of a hair mousse product, 6 grams of the test product are applied to each switch. It has been found that a preferred hair mousse embodiment of the present invention has a solids content of 23%, and that 6 grams of this hair mousse formulation was sufficient to provide complete even distribution of the product throughout the switch in the determination of hair volume values.

In order to ensure like testing conditions, the gram amount of hair styling compositions in the form of non-mousse products that is applied to each switch is determined using the following procedure: (1) determine the percent solids of the test product by using a method well known in the art for making such percent solids determinations; (2) divide 23% by the determined percent solids value, and then multiply this resulting value by 6 grams (the final value equals the gram amount of product that is applied to the hair switch); and (3) subtract the final gram value of (2) above from 6 grams (this value is the gram amount of tap water that is applied to the hair switch to provide for a total non-mousse product application of 6 grams). The gram amount of tap water is applied to the hair switch immediately prior to the application of the non-mousse test product. The gram amount of tap water can be applied to each switch using any suitable application device, typically the water is applied using a non-aerosol hairspray pump such as those available from Seaquistperfect Dispensing in Cary, Illinois.

In order to illustrate a suitable gram amount of tap water, and non-mousse test product that can be applied to a hair switch, the following example is provided. For example, if a non-mousse test product has a determined percent solids content of 50%, 23% is divided by 50% resulting in a value of 0.46. Next, multiply 6 grams by 0.46 to result in value of 2.76 grams which would be the gram amount of non-mousse test product that can be applied to the hair switch. Finally, 2.76 grams are subtracted from 6 grams to result in a value of 3.24 grams which would be the gram amount of water that can be applied to the hair switch.

Test product, and the control products, are applied to the hair switches in the 24°C/50% RH control room. The appropriate amount of tap water, if applicable, is applied to each hair switch followed by application of the appropriate amount of test or control product. Each hair switch is massaged or milked therein such that the test or control product is distributed evenly throughout the switch. Each hair switch is then combed once, turned around and combed once on the other side using the coarse toothed end of a beautician's comb or hair pick. The hair switches are then dried by allowing each switch to hang undisturbed for 30 minutes in the 24°C/50% RH control room. After 30 minutes and still while in the 24°C/50% RH control room, the dry hair switches are turned upside down and vigorously shook for 10 seconds. The dry hair switches are then turned right side up, and combed once on each side with the coarse toothed end of a beautician's comb or hair pick. Next, the dry hair switches are positioned between the thumb and forefinger such that the thumb and forefinger form a circle enclosing the top of the switches. While still in a circular arrangement, the thumb and forefinger are then ran once along the length of each switch with constant pressure, resulting in a round, not flat, disrupted dry hair switch. Each dry hair switch is then visually evaluated for volume attribute within 4 hours while maintaining the hair switches hung in the 24°C/50% RH control room.

Each panelist visually evaluates seven test product treated dry hair switches relative to the three control dry hair switches that are used as visual references. Two of the seven test product treated dry hair switches are control switches which have been included in the evaluation as test product treated hair switches. The three reference control hair switches are hung above the test product treated hair switches to establish an easily accessible reference point for the panelist. In order to ensure like evaluation procedures, the control dry hair switches which are included as test product treated switches must be evaluated such that the volume attribute is assigned a value that corresponds with that of the identical reference control switch. For example, if the test product treated dry hair switch has been treated with Control Product A (assigned volume value of 5), then this switch must be evaluated such that the volume attribute is assigned a value of 4 to 6. The criteria that this test product treated switch hair volume value is from 4 to 6 ensures that the hair volume values for this switch, and other switches evaluated along with this switch, are evaluated under intended test conditions.

A minimum of eight panelists evaluate the test product treated dry hair switches. The panelists are instructed to stand approximately six feet away from the bar on which the hair switches are hung, and to evaluate only the middle 50% portion of the hair switches to avoid any bias associated with the shoulder slope and/or flip end portions of the hair switches. The panelists record the hair volume values on the test ballot.

A total of seven dry hair switches are evaluated by each panelist, one switch for each test product including the control switches that are evaluated as a test product treated dry hair switch. Therefore, a total of five different compositions of the present invention can be evaluated in a given evaluation procedure, resulting in at least eight hair volume values being obtained for each treated dry hair switch. The mean hair

volume value for dry hair switches that have been treated with a test product is determined by averaging scores from all of the panelists for each test product treated dry hair switch. The Hair Volume Index is defined as the mean hair volume value for each test product treated dry hair switch as visually indexed to reference control switches using the assigned volume values of 0, 5, and 10 for the controls. The mean hair volume value, or Hair Volume Index, is determined using the statistical method as set forth in the Multifactor ANOVA Test Method.

d) Hair Hold Index:

The hair hold value of a treated dry hair switch, which is used in the determination of the Hair Hold Index, is determined by treating the hair switch with a composition of the present invention, setting the hair switch in a hair style using an A-Frame apparatus, shaking the hair switch to disrupt the A-Frame hair style, and measuring the remaining A-Frame hair style using a Mitutoyo CD-8C digital caliper instrument commercially available from Mitutoyo LTD located in Japan. Two control dry hair switches are analyzed along with the test product treated dry hair switches. A dry hair switch which has been treated with Control Product A is identified as the control for a dry hair switch that has an assigned hair hold value of 100, and a dry hair switch which has been treated with Control Product B is identified as the control for a dry hair switch that has an assigned value of 0.

As used herein, the term "A-Frame" refers to a 45° angled apparatus that is 76.2cm long, 25.4cm tall, and that is made of a non-porous material such as plexiglas. Other "A-Frame" hair styling apparatus can be used provided that the apparatus are made of a non-porous material.

The dry hair switches used in the procedure for the determination of the Hair Hold Index are 10 gram hair switches which are 22.9 cm long, flat, European virgin hair switches supplied by Advanced Testing Laboratories located in Cincinnati, Ohio. Each hair switch is approximately 4.8 cm wide and 0.013 cm thick.

In preparation for control and test product application, the switches are kept overnight hanging on a bar in a temperature/humidity control room having 24°C/50% RH. For hair styling compositions in the form of a hair mousse product, 1.13 grams of the test product are applied to each switch. It has been found that a preferred hair mousse embodiment of the present invention has a solids content of 23%, and that 1.13 grams of this hair mousse formulation was sufficient to provide complete even distribution of the product throughout the switch in the determination of hair hold values.

In order to ensure like testing conditions, the gram amount of hair styling compositions in the form of non-mousse products that is applied to each switch is determined using the following procedure: (1) determine the percent solids of the test product by using a method well known in the art for making such percent solids determinations; (2) divide 23% by the determined percent solid value, and then multiply this resulting value by 1.13 grams (the final value equals the gram amount of product that is applied to the hair switch), and (3) subtract the final gram value of (2) above from 1.13 grams (this value is the gram amount of tap water that is applied to the hair switch to provide for a total non-mousse product application of 1.13

grams). The gram amount of tap water is applied to the hair switch immediately prior to the application of the non-mousse test product. The gram amount of tap water is applied using the procedure described hereinbefore.

5 Test product, and the control products, are applied to the hair switches in the 24°C/50% RH control room. The appropriate amount of tap water, if applicable, is applied to each hair switch followed by application of the appropriate amount of test or control product. The test or control product is applied to each hair switch by splitting the gram amount of product in half, and applying each half-product portion along the workable hair area of each side of the switch. The term "workable hair", as used herein, refers to all hair which is between the lowest end of plexiglas materials holding the hair and 3.8 cm above the bottom
10 of the hair switch. The hair switches are held between two pieces of plexiglas materials by using adhesive material such as epoxy glue. Suitable plexiglas materials include those plexiglas materials which are 2.6 cm long, 7.75 cm wide, and 0.15 cm thick.

The product half-portions are applied by patting and/or stroking with constant pressure up and down the workable area of both sides of each hair switch. Each hair switch is then massaged or milked for
15 10 seconds such that the test or control product is distributed evenly throughout the switch. Each hair switch is then lightly stroked once by positioning the switch between the index and middle fingers, and running the index and middle fingers once along the workable area of the switch with constant pressure. Each hair switch is then divided in 2 equal sections, and hung on the A-Frame described hereinabove, such that one-half of the switch is rested on the left side of the A-Frame and one-half of the switch is rested on the
20 right side of the A-Frame. Next, the hair switches, while positioned on the A-Frame as described above, are allowed to dry for 3 hours in the 24°C/50% RH control room. Once drying is complete, each dry hair switch is prepared for hair hold measurements.

In preparation for hair hold measurements, each hair switch is placed on a suitable wrist action shaker such as the Burrell Model 75 (commercially available from VWR Scientific) to disrupt their A-
25 Frame hair style. The hair switches are placed on the shaker such that the top of the switches is placed in a three-finger clamp that is perpendicular to the shaker arm, to establish vertical hanging of the switches. The hair switches are allowed to shake for 15 minutes.

After shaking, the hair switches are hung vertically using a "C" clamp. While still in the A-Frame hair style, the half-sections of each switch are simultaneously stroked once by wrapping the hands around
30 each half-section and running the hands with constant pressure once from the lowest end of the clamp holding the switch to the end of the switch. Each switch half-section is then slowly released and allowed to freely move. Each switch hair style, which was created by the A-Frame, is then measured for hair hold using the Mitutoyo CD-8C digital caliper described hereinbefore. The hair hold measurement is taken on the area between the inner edge of each switch half-section by measuring the horizontal distance that is
35 located 3.8 cm above the bottom of each inner edge. The horizontal distance measurement is taken to the nearest millimeter using the Mitutoyo CD-8C digital caliper.

A set consisting of five hair switches are tested for each test or control product. A total of ten different compositions can be evaluated in a given evaluation procedure, eight test products and the two control products described herein. Therefore, fifty hair switches can be evaluated per evaluation procedure. The mean hair hold value is determined by averaging the measured hair hold score from each treated dry hair switch for each set. The mean hair hold value is used to calculate the Hair Hold Index of a given test product using the following formula:

$$\text{Hair Hold Index} = \frac{\text{Test Product Mean} - \text{Control Product B Mean}}{\text{Control Product A Mean} - \text{Control Product B Mean}} \times 100$$

Preferred Embodiments

The hair styling compositions of the present invention preferably include aerosol hair styling embodiments, especially hair mousse embodiments. The aerosol hair styling compositions of the present invention comprise the styling agent and liquid carrier described herein, and further comprise a propellant suitable for aerosol delivery of the composition to the desired application surface.

The total concentration of the propellant in the aerosol hair styling composition can include one or more propellants, the total propellant concentration typically ranging from about 5% to about 40%, preferably from about 5% to about 25%, more preferably from about 5% to about 15%, by weight of the composition.

Nonlimiting examples of suitable propellants include hydrocarbons, nitrogen, carbon dioxide, nitrous oxide, atmospheric gas, 1,2-difluoroethane (Hydrofluorocarbon 152A) supplied as Dymel 152A by Dupont, dimethylether, and mixtures thereof. Preferred are the hydrocarbon propellants, specific examples of which include propane, butane, and isobutane. Most preferred is a hydrocarbon propellant containing a mixture of propane and isobutane, specific examples of which include Aeron A-46 and Aeron A-70 (both are commercially available from Diversified CPC).

Optional Components

In addition to the essential components described hereinbefore, the hair styling compositions of the present invention may further comprise one or more optional components known or otherwise effective for use in hair care or personal care products, provided that the optional components are physically and chemically compatible with the essential components described herein, or do not otherwise unduly impair product stability, aesthetics, or performance. Nonlimiting examples of such optional components are disclosed in *International Cosmetic Ingredient Dictionary*, Fifth Edition, 1993, and *CTFA Cosmetic Ingredient Handbook*, Second Edition, 1992, both of which are incorporated by reference herein in their entirety. Some nonlimiting examples of such optional components are disclosed below.

Optional Gelling Agent

The hair styling compositions of the present invention preferably further comprise a gelling agent to help provide the desired viscosity to the residue which remains on the hair after the composition has been applied and allowed to dry on the hair. The preferred optional gelling agent also helps to provide for improved hair hold performance. Suitable optional gelling agents include any material known or otherwise effective in providing any gelling or measurable viscosity increase to the residue. The concentrations of the optional gelling agent in the compositions range from about 0.1% to about 10%, preferably from about 0.2% to about 5.0%, by weight of the compositions.

Nonlimiting examples of suitable optional gelling agents include crosslinked carboxylic acid polymers; unneutralized crosslinked carboxylic acid polymers; unneutralized modified crosslinked carboxylic acid polymers; crosslinked ethylene/maleic anhydride copolymers; unneutralized crosslinked ethylene/maleic anhydride copolymers (e.g., EMA 81 commercially available from Monsanto); unneutralized crosslinked allyl ether/acrylate copolymers (e.g., Salcare SC90 commercially available from Allied Colloids); unneutralized crosslinked copolymers of sodium polyacrylate, mineral oil, and PPG-1 trideceth-6 (e.g., Salcare SC91 commercially available from Allied Colloids); unneutralized crosslinked copolymers of methyl vinyl ether and maleic anhydride (e.g., Stabileze QM-PVM/MA copolymer commercially available from International Specialty Products); hydrophobically modified nonionic cellulose polymers; hydrophobically modified ethoxylate urethane polymers (e.g., Ucare Polyphobe Series of alkali swellable polymers commercially available from Union Carbide); and combinations thereof. In this context, the term "unneutralized" means that the optional polymer and copolymer gelling agent materials contain unneutralized acid monomers.

Preferred optional gelling agents include water-soluble unneutralized crosslinked ethylene/maleic anhydride copolymers, water-soluble unneutralized crosslinked carboxylic acid polymers, and water-soluble hydrophobically modified nonionic cellulose polymers. The crosslinked carboxylic acid polymers and hydrophobically modified nonionic cellulose polymers are described in detail hereinbelow.

25 Carboxylic Acid Polymers

The optional carboxylic acid polymers suitable for use herein are those crosslinked compounds containing one or more monomers derived from acrylic acid, substituted acrylic acids, esters of acrylic acid, esters of substituted acrylic acids, corresponding salts thereof, and combinations thereof, wherein the crosslinking agent contains two or more carbon-carbon double bonds and is derived from a polyhydric alcohol. Specific examples of these carboxylic acid polymers include crosslinked carboxylic acid homopolymers and crosslinked carboxylic acid copolymers. Combinations of these two types of polymers are also useful herein.

The term "substituted" as used herein refers to chemical moieties known or otherwise effective for attachment to gelling agents or other compounds. Such substituents include those listed and described in C. Hansch and A. Leo, *Substituent Constants for Correlation Analysis in Chemistry and Biology* (1979), which listing and description are incorporated herein by reference. Examples of such substituents include, but are

not limited to, alkyl, alkenyl, alkoxy, hydroxy, oxo, nitro, amino, aminoalkyl (e.g., aminomethyl, etc.), cyano, halo, carboxy, alkoxyaceyl (e.g., carboethoxy, etc.), thiol, aryl, cycloalkyl, heteroaryl, heterocycloalkyl (e.g., piperidinyl, morpholinyl, pyrrolidinyl, etc.), imino, thioxo, hydroxyalkyl, aryloxy, arylalkyl, and combinations thereof.

5 The term "corresponding salts" as used herein refers to cationic salts formed at any acidic (e.g., carboxyl) group, or anionic salts formed at any basic (e.g., amino) group, either of which are suitable for topical application to human skin. Many such salts are known in the art, examples of which are described in World Patent Publication 87/05297, Johnston et al., published September 11, 1987, which description is incorporated herein by reference.

10 Preferred optional crosslinked carboxylic acid polymers are those crosslinked carboxylic acid homopolymers or copolymers which contain unneutralized acid monomers. It has been found that crosslinked carboxylic acid polymers which have unneutralized acid monomers are especially effective in providing gelling properties to the residue without suppressing the ease of removability of the residue by shampooing the hair.

15 Partially or fully neutralized crosslinked carboxylic acid polymers are also suitable for use as an optional gelling agent in the hair styling compositions of the present invention, provided that these carboxylic acid polymers are included in combination with one or more styling agents which have an average solubility parameter of above about $14 \text{ (cal/cm}^3)^{0.5}$ to about $20 \text{ (cal/cm}^3)^{0.5}$. Solubility parameters for the styling agents or other materials, and means for determining such parameters, are well known in the chemical arts. A description of solubility parameters and means for determining them are described by
20 C.D. Vaughan, "Solubility Effects in Product, Package, Penetration and Preservation" 103 Cosmetics and Toiletries 47-69, October 1988; and C. D. Vaughan, "Using Solubility Parameters in Cosmetics Formulation", 36 J. Soc. Cosmenc Chemists 319-333, September/October, 1988, which descriptions are incorporated herein by reference.

25 Suitable crosslinked carboxylic acid homopolymers include those crosslinked homopolymers which have an acrylic acid monomer, or derivative thereof, (e.g., wherein the acrylic acid has substituents on the two and three carbon positions independently selected from the group consisting of C_{1-4} alkyl, -CN, -COOH, and mixtures thereof). Preferred monomers include acrylic acid, methacrylic acid, ethacrylic acid, and mixtures thereof, with acrylic acid being the most preferred.

30 Suitable crosslinked carboxylic acid copolymers include those crosslinked copolymers which have a first monomer selected from the group consisting of an acrylic acid or derivative thereof as defined above, a short chain alcohol (i.e., a C_{1-4}) acrylate ester monomer or derivative thereof (e.g., wherein the acrylic acid portion of the ester has substituents on the two and three carbon positions independently selected from the group consisting of C_{1-4} alkyl, -CN, -COOH, and mixtures thereof), and mixtures thereof; and a second
35 monomer which is a long chain alcohol (i.e. C_{8-40}) acrylate ester monomer or derivative thereof (e.g., wherein the acrylic acid portion of the ester has substituents on the two and three carbon positions

independently selected from the group consisting of C₁₋₄ alkyl, -CN, -COOH, and mixtures thereof. Preferred first monomers include acrylic acid, methacrylic acid, and ethacrylic acid, C₁₋₄ alcohol acrylate esters, C₁₋₄ alcohol methacrylate esters, C₁₋₄ alcohol ethacrylate esters, and mixtures thereof, with acrylic acid, methacrylic acid, C₁₋₄ alcohol acrylate esters, C₁₋₄ alcohol methacrylate esters, and mixtures thereof being the most preferred. Preferred second monomers include C₈₋₄₀ alkyl acrylate esters, with C₁₀₋₃₀ alkyl acrylate esters being the most preferred. In other words, the preferred crosslinked carboxylic acid copolymers include those copolymers which have a first monomer selected from the group consisting of acrylic acid, methacrylic acid, C₁₋₄ alcohol acrylate esters, C₁₋₄ alcohol methacrylate esters, and mixtures thereof, and a C₁₀₋₃₀ alkyl acrylate ester second monomer.

The crosslinking agent in both of these types of polymers is a polyalkenyl polyether of a polyhydric alcohol containing more than one alkenyl ether group per molecule, wherein the parent polyhydric alcohol contains at least 3 carbon atoms and at least 3 hydroxyl groups. Preferred crosslinking agents are those selected from the group consisting of allyl ethers of sucrose, allyl ethers of pentaerythritol, and mixtures thereof.

Examples of commercially available crosslinked carboxylic acid homopolymers suitable for use herein include the carbomers, which are homopolymers of acrylic acid crosslinked with allyl ethers of sucrose or pentaerythritol. The carbomers are available as the Carbopol® 900 series from B.F. Goodrich. Most preferred are the commercially available carbomers which have unneutralized acid monomers.

Examples of commercially available crosslinked carboxylic acid copolymers suitable for use herein include copolymers of C₁₀₋₃₀ alkyl acrylates with one or more monomers of acrylic acid, methacrylic acid, or one of their short chain (i.e. C₁₋₄ alcohol) esters, wherein the crosslinking agent is an allyl ether of sucrose or pentaerythritol. These copolymers are known as acrylates/C₁₀₋₃₀ alkyl acrylate crosspolymers and are commercially available as Carbopol® 1342, Pemulen TR-1, and Pemulen TR-2, from B.F. Goodrich.

Suitable crosslinked carboxylic acid polymers are more fully described in U.S. Patent No. 5,087,445, to Haffey et al., issued February 11, 1992; U.S. Patent No. 4,509,949, to Huang et al., issued April 5, 1985; U.S. Patent No. 2,798,053, to Brown, issued July 2, 1957, which descriptions are incorporated by reference herein. See also, CTEA International Cosmetic Ingredient Dictionary, fourth edition, 1991, pp. 12 and 80, which description is also incorporated herein by reference.

Nonionic Cellulose Polymers

The preferred optional gelling agent suitable for use in the hair styling compositions of the present invention also include water-soluble hydrophobically modified nonionic cellulose polymers. The term "water-soluble hydrophobically modified nonionic polymers" refers to those water-soluble nonionic polymers which have been modified to comprise substituted hydrophobic groups to make the polymer less soluble in water. Hence, the nonionic cellulose polymers comprise a water-soluble cellulosic chain (or hydrophilic cellulosic chain) which forms the backbone, wherein the backbone comprise substituted

hydrophobic groups. Suitable substituted hydrophobic groups include C8-C22 alkyl, arylalkyl, alkylaryl groups, and mixtures thereof. The degree of substitution on the backbone should be from about 0.10% to about 1.0%, depending on the particular polymer backbone. The nonionic cellulose polymers generally contain a ratio of hydrophilic substituents to hydrophobic substituents of from about 10:1 to about 1000:1.

5 Nonlimiting examples of preferred hydrophobically modified nonionic cellulose polymers include those nonionic cellulose polymers which comprise a cellulose ether substrate and a long chain alkyl modifier. In this context, the term "long chain alkyl modifier" means that the modifying compound can comprise an alkyl radical or other functional groups such as an alphahydroxyalkyl radical, a urethane radical, or an acyl radical. These polymers, and methods of making the polymers, are also described in U.S.
10 Patent 4,228,277, issued to Landoll on October 14, 1980, which description is incorporated herein by reference.

Suitable cellulose ether substrates include any known or otherwise effective water-soluble nonionic cellulose ether. Nonlimiting examples of suitable water-soluble nonionic cellulose ethers include, but are not limited to: hydroxyethyl cellulose, hydroxypropyl cellulose, methyl cellulose, hydroxypropyl methyl
15 cellulose, ethyl hydroxyethyl cellulose, and methyl hydroxyethyl cellulose. The amount of the nonionic substituent (e.g., methyl, hydroxyethyl, or hydroxypropyl substituent) is not critical provided that the amount is sufficient to assure that the ether is water-soluble.

The preferred cellulose ether substrate is hydroxyethyl cellulose (HEC) which has a weight average molecular weight of from about 50,000 to about 700,000. It has been found that hydroxyethyl cellulose is
20 the most hydrophilic suitable cellulose ether substrate, and therefore, can allow for greater modification than other suitable water-soluble cellulose ether substrates before water-insolubility is achieved. Accordingly, control of the modification process and control of the properties of the modified substrate can be more precise with hydroxyethyl cellulose substrates. Hydrophilicity of the most commonly used nonionic cellulose ethers ranges from hydroxyethyl to hydroxypropyl to hydroxypropylmethyl to methyl, with
25 hydroxyethyl being the most hydrophilic and methyl being the least hydrophilic.

The long chain alkyl modifier can be attached to the cellulose ether substrate via an ether, ester, or urethane linkage. The ether linkage is preferred. The size and effect of the hydrocarbon chain of suitable modifiers effectively conceals any noticeable effect derived from functional groups other than alkyl halides which links the modifier to the substrate. In other words, if the long chain alkyl modifier is an epoxide
30 containing an alphahydroxyalkyl radical, an isocyanate containing a urethane radical, or an acyl chloride containing an acyl radical, the effect of these functional groups are unnoticeable and the performance of the hydrophobically modified nonionic cellulose polymer is not significantly different from a polymer modified with an alkyl halide modifier.

Specific examples of preferred hydrophobically modified nonionic cellulose polymers include
35 Natrosol Plus Grade 330, and Natrosol Plus CS Grade D-67, both commercially available from the Aqualon Company located in Wilmington, Delaware. Natrosol Plus Grade 330 is a hydrophobically modified

hydroxyethylcellulose which has a weight average molecular weight of approximately 300,000 prior to modification; which has been substituted with from about 0.4% to about 0.8%, by weight, of an alkyl modifier having sixteen carbon atoms; and which has a hydroxyethyl molar substitution of from about 3.0 to about 3.7. Natrosol Plus CS Grade D-67 is a hydrophobically modified hydroxyethylcellulose which has a weight average molecular weight of approximately 700,000 prior to modification; which has been substituted with from about 0.50% to about 0.95%, by weight, of an alkyl modifier having sixteen carbon atoms; and which has a hydroxyethyl molar substitution of from about 2.3 to about 3.3.

Other cellulose polymers which can provide measurable viscosity increase to the residue are also suitable for use as an optional gelling agent herein. A specific example of other suitable cellulose polymers include a water-soluble hydrophobically modified cationic cellulose polymer commercially available as Quatrosoft from Amerchol.

Optional Feel Enhancers

The hair styling compositions of the present invention may further comprise a feel enhancer to help provide improved dry hair feel. Concentrations of the optional feel enhancer will typically range from about 0.1% to about 15%, preferably from about 0.2% to about 10%, more preferably from about 0.5% to about 10%, by weight of the compositions.

Suitable optional feel enhancers include nonvolatile silicones, cationic polymers excluding the cationic polymers suitable for use as optional styling polymers or optional gelling agents herein, cationic surfactants, and mixtures thereof. These feel enhancers help to provide improved dry hair feel benefits such as nonsticky, unstiff, flexible, and natural feeling hair.

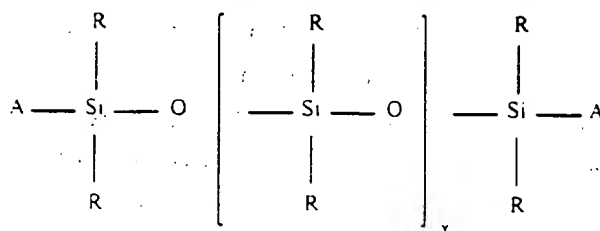
Nonlimiting examples of nonvolatile silicones suitable for use as an optional feel enhancer herein include nonvolatile soluble silicones, nonvolatile insoluble silicones, or combinations thereof. In this context, the term "soluble" means that the silicone feel enhancer is miscible with the liquid carrier so as to form part of the same phase. Conversely, the term "insoluble" means that the silicone feel enhancer forms a separate, discontinuous phase from the liquid carrier, such as in the form of an emulsion, microemulsion, or a suspension of droplets of the silicone. The term "nonvolatile", as used in this context means that the silicone feel enhancer has a boiling point of at least about 265°C, preferably at least about 275°C, more preferably at least about 300°C. Such materials exhibit very low or no significant vapor pressure at ambient conditions.

Suitable nonvolatile soluble silicones include silicone copolyols, such as dimethicone copolyols, e.g. polyether siloxane-modified polymers, such as polypropylene oxide, polyethylene oxide modified polydimethylsiloxane, wherein the level of ethylene and/or propylene oxide is sufficient to allow solubility in the composition.

Suitable nonvolatile insoluble silicones include those insoluble silicone fluids such as polyalkylsiloxanes, polyarylsiloxanes, polyalkylaryl siloxanes, polyether siloxane copolymers, and mixtures thereof. Other nonvolatile insoluble silicone fluids having feel enhancing properties can also be used. In

this context, the term "silicone fluid" refers to those silicone materials which have a viscosity of less than about 1,000,000 centistokes (cs) at 25°C. Generally, the viscosity of the fluid will be between about 5 cs and about 1,000,000 cs, preferably between about 10 cs and about 300,000 cs at 25°C. The viscosity can be measured by means of a glass capillary viscometer as set forth in Dow Corning Corporate Test Method
 5 CTM0004, July 20, 1970.

Nonlimiting examples of silicone fluids for use in the hair styling compositions of the present invention include polyalkyl or polyaryl siloxanes which conform to the formula:



wherein R is alkyl or aryl, and x is an integer from about 7 to about 8,000. "A" represents groups which
 10 block the ends of the silicone chains.

The alkyl or aryl groups substituted on the siloxane chain (R) or at the ends of the siloxane chains (A) may have any structure as long as the resulting silicones remain fluid at ambient conditions, are hydrophobic, are neither irritating, toxic nor otherwise harmful when applied to the hair or skin, are compatible with the other components of the composition, are chemically stable under normal use and
 15 storage conditions, and are capable of being deposited on and of improving the feel of hair or skin.

Suitable A groups include methyl, ethyl, phenyl, phenylene, hydroxy, methoxy, ethoxy, propoxy, and aryloxy. The two R groups on the silicone atom may represent the same group or different groups. Preferably, the two R groups represent the same group. Suitable R groups include methyl, ethyl, propyl, phenyl, methylphenyl and phenylmethyl. The preferred silicone fluids are
 20 polydimethylsiloxane, polydiethylsiloxane, and polymethylphenylsiloxane. Polydimethylsiloxane is most preferred.

Specific examples of nonvolatile insoluble silicone fluids include, but are not limited to, polydimethylsiloxanes such as the Viscasil R® and SF96® series (commercially available from the General Electric Co.), and the Dow Corning 200® series (commercially available from Dow Corning
 25 Corp.); polymethylphenylsiloxane such as SF1075® methyl phenyl fluid (commercially available from the General Electric Co.), and 556 Cosmetic Grade Fluid® (commercially available from Dow Corning Corp.); and a polypropylene oxide modified polydimethylsiloxane such as Dow Corning DC-1248®.

Other suitable silicone fluids are disclosed in U.S. Patent 2,826,551, issued to Geen; U.S. Patent 3,964,500, issued to Drakoff, on June 22, 1976; U.S. Patent 4,364,837, issued to Pader; and
 30 British Patent 849,433, issued to Woolston, all of which disclosures are incorporated herein by reference.

Other suitable silicone feel enhancers include insoluble silicone gum. The term "silicone gum", as used herein, means polyorganosiloxane materials having a viscosity at 25°C of greater than or equal to 1,000,000 centistokes. Silicone gums are described by Petrarch and others including U.S. Patent 4,152,416, Spitzer et al., issued May 1, 1979; and Noll, Walter, Chemistry and Technology of Silicones, New York: Academic Press 1968. The "silicone gums" will typically have a mass molecular weight in excess of about 200,000, generally between about 200,000 and about 1,000,000. Specific examples include polydimethylsiloxane, (polydimethylsiloxane) (methylvinylsiloxane) copolymer, poly(dimethylsiloxane) (diphenyl siloxane)(methylvinylsiloxane) copolymer, and mixtures thereof.

Other suitable silicone feel enhancers include a silicone resin. Silicone resins are highly crosslinked polymeric siloxane systems. The crosslinking is introduced through the incorporation of trifunctional and tetrafunctional silanes with monofunctional or difunctional, or both, silanes during manufacture of the silicone resin. As is well understood in the art, the degree of crosslinking that is required in order to result in a silicone resin will vary according to the specific silane units incorporated into the silicone resin. In general, silicone materials which have a sufficient level of trifunctional and tetrafunctional siloxane monomer units (and hence, a sufficient level of crosslinking) such that they dry down to a rigid, or hard, film are considered to be silicone resins. The ratio of oxygen atoms to silicon atoms is indicative of the level of crosslinking in a particular silicone material. Silicone materials which have at least about 1.1 oxygen atoms per silicon atom will generally be silicone resins herein. Preferably, the ratio of oxygen:silicon atoms is at least about 1.2:1.0. Silanes used in the manufacture of silicone resins include monomethyl-, dimethyl-, trimethyl-, monophenyl-, diphenyl-, methylphenyl-, monovinyl-, and methylvinyl-chlorosilanes, and tetrachlorosilane, with the methyl-substituted silanes being most commonly utilized. Preferred resins are offered by General Electric as GE SS4230® and SS4267®. Commercially available silicone resins will generally be supplied in a dissolved form in a low viscosity volatile or nonvolatile silicone fluid. The silicone resins for use herein should be supplied and incorporated into the present compositions in such dissolved form, as will be readily apparent to those skilled in the art.

Background material on silicones including sections discussing silicone fluids, gums, and resins, as well as manufacture of silicones, can be found in Encyclopedia of Polymer Science and Engineering, Volume 15, Second Edition, pp 204-308, John Wiley & Sons, Inc., 1989, incorporated herein by reference.

Other Optional Materials

Other optional materials suitable for use in the hair styling compositions of the present invention include, but are not limited to, preservatives, surfactants, conditioning polymers, electrolytes, fatty alcohols, hair dyes, antidandruff actives, odor masking agents, pH adjusting agents, perfume oils, perfume solubilizing agents, sequestering agents, emollients, lubricants and penetrants such as various lanolin compounds, protein hydrolysates and other protein derivatives, sunscreens, volatile silicone fluids, and

isoparaffins. The concentration of such optional ingredients generally ranges from zero to about 25%, more typically from about 0.05% to about 25%, even more typically from about 0.1% to about 15%, by weight of the composition.

Method of Manufacture

The hair styling compositions of the present invention may be prepared by any known or otherwise effective technique suitable for providing a hair styling composition, provided that the composition is formulated to provide for hair volume and hair hold performance as defined by the DRY HAIR INDEX described herein.

Methods for preparing the hair styling compositions of the present invention include conventional formulation and mixing techniques. Suitable methods include combining the styling agent with the liquid carrier, and thoroughly mixing until the styling agent is homogeneously dispersed and dissolved in the liquid carrier. Any remaining ingredients such as perfume, the optional styling polymer, and the optional preferred gelling agent, can then be added and dispersed into the mixture. The resultant liquid mixture is then packaged into a suitable container for packaging such hair styling compositions.

The aerosol hair styling composition of the present invention can be contained or dispensed in any known or otherwise effective aerosol container or delivery system. All such containers or delivery systems should be compatible with the essential and any selected optional ingredients of the hair styling composition of the present invention. Typically, the aerosol hair styling composition of the present invention are packaged into an aerosol dispenser, and propellant is then added. Alternatively, pressurized aerosol dispensers can be used where the propellant is separated from contact with the hair styling composition by use of specialized containers such as a two compartment can of the type sold under the tradename SEPRO from American National Can Corp.

Method Of Use

The hair styling compositions of the present invention are used in a conventional manner to provide for dry hair style, hair volume, and hair hold performance. An effective amount of the composition is either sprayed or applied onto dry hair before or after the hair is styled. As used herein "effective amount" means an amount sufficient to provide the hair volume, hair hold, and style performance desired according to the length and texture of the hair.

EXAMPLES

The following examples further describe and demonstrate embodiments within the scope of the present invention. The examples are given solely for the purpose of illustration and are not to be construed as limitations of the present invention, as many variations thereof are possible without departing from the

spirit and scope of the invention. All exemplified concentrations are weight-weight percents, unless otherwise specified.

Examples I-VIII

The following Examples I-VIII describe hair mousse compositions of the present invention. Each of the exemplified compositions are prepared by combining all of the listed components, except the propellant, and mixing the combination for 40 minutes. The resultant liquid mixture is then filled into an aerosol container, and the propellant is added. Each of the exemplified hair mousse compositions provides for improved hair volume and hair hold performance as defined by the DRY HAIR INDEX described herein.

Hair Mousse Compositions

Component:	Example I	Example II	Example III	Example IV
PEG-8 ¹	25.0	---	---	---
PEG-12 ²	---	---	15.0	---
PEG-20 ³	---	20.0	---	25.0
Ethanol (Denatured)	5.0	5.0	5.0	5.0
Polydimethylsiloxane (350 cs) ⁴	---	5.0	---	5.0
Dilauryl Acetyl Dimonium Chloride ⁵	5.0	---	---	---
Triglycerin	---	---	---	---
Sodium Cocoyl Isethionate	---	---	0.50	---
Benzyl Alcohol	0.50	0.50	0.50	---
DMDM Hydantoin	---	---	---	0.50
Undeceth-9 ⁶	---	0.50	0.50	---
Cocamide DEA	---	---	---	0.50
Lauramide DEA	---	---	---	0.50
Phenoxyethanol	0.30	0.30	0.30	0.30
Perfume	0.15	0.15	0.15	0.15
Disodium EDTA	0.09	0.12	0.12	0.12
Propellant Aeron A-70	---	---	10.0	---
Propellant Aeron A-46	7.0	7.0	---	10.0
Distilled Water	qs	qs	qs	qs

1 - Carbowax 400 available from Union Carbide

2 - Carbowax 600 available from Union Carbide

3 - Carbowax 900 available from Union Carbide

4 - SF96-350 available from General Electric

5 - Schercoquat ALA available from Scher

6 - Neodol 1-9 available from Shell

7 - Propane/Isobutane mixture available from Diversified CPC

Hair Mousse Compositions

Component:	Example V	Example VI	Example VII	Example VIII
PEG-6 ⁸	---	10.0	---	---
PEG-8 ¹	20.0	---	20.0	---
PEG-18	---	---	---	15.0
PEG-32 ⁹	---	10.0	---	---
Ethanol (Denatured)	---	5.0	10.0	---
DC 2-1559 Emulsion ¹⁰	10.0	---	---	0.15
Triglycerin	---	---	---	5.0
Glycerin	5.0	---	---	---
Silicone-Polyether Copolymer	---	---	5.0	---
Ditallowdimonium Chloride	---	0.50	---	---
Benzyl Alcohol	---	---	0.50	---
Undeceth-9 ¹¹	---	0.50	---	---
Cocamide DEA	---	---	0.50	---
Cocamidopropyl Betaine	---	---	0.50	---
Phenoxyethanol	---	---	0.30	---
Stearyltrimonium Chloride	0.30	---	---	0.30
PEG-60 Castor Oil	0.20	---	---	0.20
Perfume	---	0.15	0.15	---
Propellant Aeron A-70	---	10.0	7.0	---
Propellant Aeron A-46	10.0	---	---	10.0
Distilled Water	qs	qs	qs	qs

8 - Carbowax 300 available from Union Carbide

9 - Carbowax 1450 available from Union Carbide

10 - 60% silicone emulsion available from Dow Corning

11 - Silwet L-77 available from Witco

5

Examples IX-XVII

The following Examples IX-XVII describe hair mousse compositions of the present invention. Each of the exemplified compositions are prepared by adding the styling agent to water and mixing for one hour until the styling agent is dissolved. The remaining ingredients, except the propellant, are then added and the resulting solution is stirred. The composition is then packaged into an aerosol container, and the propellant is added. Each of the exemplified hair mousse compositions provides for improved hair volume and hair hold performance as defined by the DRY HAIR INDEX described herein.

10

Hair Mousse Compositions

Component:	Example IX	Example X	Example XI	Example XII
PEG-8 ¹	18.0	18.0	15.0	10.0
PEG-12 ²	---	---	---	---
PEG-20 ³	---	---	---	---
Kytamer L ¹²	---	1.80	---	---
EMA 81 ¹³	0.72	---	---	---
Laponite XLG ¹⁴	---	---	1.00	---
Hexaglycerol ¹⁵	---	---	---	10.0
Carbopol 934 ¹⁶	---	---	---	0.10
Permulan TR-1 ¹⁷	---	---	---	---
Benzyl Alcohol	0.45	0.45	0.50	0.50
Phenoxyethanol	0.27	0.27	0.30	0.30
Undeceth-9 ³	0.27	0.27	0.30	0.30
Sodium Cocoyl Isethionate	0.18	---	---	0.20
Disodium EDTA	0.11	---	0.12	0.12
Perfume	0.13	0.11	0.15	0.15
Aminomethylpropanol	---	---	---	0.10
Kathon CG ¹⁸	---	---	---	---
Propellant Aeron A-46	10.0	---	7.50	10.0
Propellant Aeron A-70	---	10.0	---	---
Distilled Water	qs	qs	qs	qs

12 - neutralized Chitosan available from Amerchol

13 - unneutralized ethylene/maleic anhydride copolymer available from Monsanto

14 - styling clay available from Southern Clay Products

15 - available from Solvay Interox, Inc

16 - crosslinked carboxylic acid homopolymer available from B. F. Goodrich

17 - crosslinked carboxylic acid copolymer available from B. F. Goodrich

18 - preservative available from Rohm & Haas

Hair Mousse Compositions

Component:	Example XIII	Example XIV	Example XV	Example XVI	Example XVII
PEG-8 ¹	20.0	---	---	16.0	20.0
PEG-12 ²	---	12.50	---	---	---
PEG-20 ³	---	---	15.0	---	---
Sodium Carrageenan ¹⁹	---	---	---	1.50	---
Celquat SC 240 ²⁰	---	---	---	---	1.00
Carbopol 934 ¹⁶	0.50	0.50	---	---	---
Permulan TR-1 ¹⁷	---	---	0.50	---	---
Benzyl Alcohol	0.50	0.50	---	---	---
Phenoxyethanol	0.30	0.30	---	---	---
Undeceth-9 ³	0.30	0.15	0.30	---	---
Sodium Cocoyl Isethionate	---	0.15	0.20	0.40	0.35
Disodium EDTA	0.12	0.12	---	---	---
Perfume	0.15	0.15	0.15	0.12	0.25
Aminomethylpropanol	---	---	---	---	---
Kathon CG ¹⁸	---	---	0.04	0.04	0.04
Propellant Aeron A-46	---	---	10.0	---	---
Propellant Aeron A-70	10.0	10.0	---	---	---
Distilled Water	qs	qs	qs	qs	qs

19 - anionic polysaccharide polymer available from Aquaion

20 - cationic polysaccharide copolymer available from National Starch

Example XVIII

The hair styling compositions of the present invention include the pomade embodiment described below. The pomade is formulated by dispersing the Carbopol 934 into a solution containing all the listed ingredients except the aminomethylpropanol, and thoroughly mixing for 30 minutes. The aminomethylpropanol is then slowly added to and thoroughly mixed in the resulting solution for 10 minutes. The resultant composition may be packaged into any well known container for packaging such pomade compositions. The exemplified pomade composition of the present invention provides for improved hair volume and hair hold performance as defined by the DRY HAIR INDEX described herein.

10

Pomade Composition

Component	Weight %
PEG-14	80.00
Carbopol 934 ¹⁰	1.00
Aminomethylpropanol	0.30
Polysorbate 80	0.40
Fragrance	0.20
Distilled Water	qs

Example XIX

The hair styling compositions of the present invention include the spray-on-gel embodiment described below. The spray-on-gel is formulated by combining all the listed ingredients, except the propellant, and mixing the combination for 10 minutes. The composition is then packaged into an aerosol container, and the propellant is added. The exemplified spray-on gel composition of the present invention provides for improved hair volume and hair hold performance as defined by the DRY HAIR INDEX described herein.

20

Spray-on-Gel Composition

Component	Weight %
PEG-20	18.00
Fragrance	0.10
Isobutane	5.00
Dimethyl Ether	25.00
Ethanol, Denatured	20.00
Distilled Water	qs

25

The following Examples XX-XXI describe pump hairspray compositions of the present invention. Example XX is prepared by adding the ethylene/maleic anhydride copolymer (EMA 81) to water and mixing for one hour until the EMA 81 is dissolved. The remaining ingredients are then added and the resulting solution is stirred. Example XXI is prepared by combining all of the listed ingredients, and mixing the combination for 15 minutes. Each of the exemplified hairspray compositions provides for improved hair volume and hair hold performance as defined by the DRY HAIR INDEX described herein.

Pump Hairspray Compositions

Component	Example XX	Example XXI
PEG-8 ¹	18.00	---
PEG-12 ²	---	16.00
Ethanol (Denatured)	---	50.00
EMA 81 ¹³	0.72	---
Benzyl Alcohol	0.45	---
Phenoxyethanol	0.27	---
Undeceth-9 ⁹	0.27	---
Sodium Cocoyl Isethionate	0.18	---
Fragrance	0.13	0.20
Disodium EDTA	0.11	---
Distilled Water	qs	qs

Example XXII

The hair styling compositions of the present invention include the hair tonic embodiment described below. The hair tonic is prepared by adding the Kytamer L styling polymer to water and mixing for one hour until the styling polymer is dissolved. The remaining ingredients are then added and the resulting solution is stirred. The exemplified hair tonic composition of the present invention provides for improved hair volume and hair hold performance as defined by the DRY HAIR INDEX described herein.

Hair Tonic Composition

Component	Weight %
PEG-8 ¹	18.00
Kytamer L ¹²	1.80
Benzyl Alcohol	0.45
Phenoxyethanol	0.27
Undeceth-9 ⁹	0.27
Fragrance	0.11
Distilled Water	qs

WHAT IS CLAIMED IS:

1. An aqueous hair styling composition comprising:
 - (a) from about 12% to about 90% by weight of a polyalkylene glycol styling agent that is substantially free of polyalkylene glyceryl ethers and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals, wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and
 - (b) from about 1% to about 88% by weight of water;wherein after application and drying of the composition on dry hair the composition provides for a DRY HAIR INDEX of at least 242.
2. The composition of Claim 1 wherein the DRY HAIR INDEX is at least 266.
3. The composition of Claim 2 wherein the DRY HAIR INDEX is at least 280.
4. The composition of Claim 1 wherein the composition comprises from about 12% to about 50% by weight of the polyalkylene glycol.
 5. The composition of Claim 4 wherein the polyalkylene glycol is selected from the group consisting of ethoxy polyethylene/polypropylene glycol copolymers, methoxy polyethylene/polypropylene glycol copolymers, propoxy polyethylene/polypropylene glycol copolymers, butoxy polyethylene/polypropylene glycol copolymers, pentoxy polyethylene/polypropylene glycol copolymers, triglycerin, hexaglycerin, PPG-4, PPG-6, PEG-5, PEG-6, PEG-8, PEG-12, PEG-14, PEG-18, PEG-20, PEG-32, and mixtures thereof.
6. The composition of Claim 5 wherein the polyalkylene glycol is selected from the group consisting of PPG-4, PEG-8, PEG-12, PEG-20, and mixtures thereof.
7. The composition of Claim 1 wherein the composition further comprises an organic solvent selected from the group consisting of C₁-C₆ alkanols, carbitol, acetone, and mixtures thereof.
8. The composition of Claim 7 wherein the composition comprises from about 40% to about 88% by weight of water and from about 1% to about 15% by weight of the organic solvent.
9. The composition of Claim 8 wherein the organic solvent is a C₁-C₆ alkanol selected from the group consisting of ethanol, n-propanol, isopropanol, n-butanol, amyl alcohol, and mixtures thereof.

10. The composition of Claim 1 wherein the composition further comprises a combination of the polyalkylene glycol and a polysaccharide styling polymer.
11. The composition of Claim 10 wherein the polysaccharide styling polymer is selected from the group
5 consisting of glucosamine polysaccharide derivatives, cationic polysaccharides, anionic polysaccharides, and mixtures thereof.
12. The composition of Claim 1 wherein the composition further comprises a gelling agent.
- 10 13. The composition of Claim 12 wherein the gelling agent is a water-soluble polymer selected from the group consisting of crosslinked ethylene/maleic anhydride copolymers, crosslinked carboxylic acid polymers, hydrophobically modified nonionic cellulose polymers, and mixtures thereof.
- 15 14. The composition of Claim 1 wherein the composition is in the form of an aerosol aqueous hair styling product.
15. The composition of Claim 15 wherein the composition comprises a propellant selected from the group consisting of propane, butane, isobutane, nitrogen, carbon dioxide, nitrous oxide, atmospheric gas, 1,2-difluoroethane, dimethylether, and mixtures thereof.
- 20 16. A non-aqueous hair styling composition comprising:
- (a) from about 12% to about 90% by weight of a polyalkylene glycol styling agent that is substantially free of polyalkylene glyceryl ethers and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide
25 radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms, and
- (b) from about 1% to about 88% by weight of a non-aqueous liquid carrier;
- wherein after application and drying of the composition on dry hair the composition provides for a DRY HAIR INDEX of at least 266.
- 30 17. The composition of Claim 16 wherein the DRY HAIR INDEX is at least 280.
18. The composition of Claim 16 wherein the composition comprises from about 12% to about 50% by weight of the polyalkylene glycol.
- 35

19. The composition of Claim 18 wherein the polyalkylene glycol is selected from the group consisting of ethoxy polyethylene/polypropylene glycol copolymers, methoxy polyethylene/polypropylene glycol copolymers, propoxy polyethylene/polypropylene glycol copolymers, butoxy polyethylene/polypropylene glycol copolymers, pentoxy polyethylene/polypropylene glycol copolymers, triglycerin, hexaglycerin, PPG-4, PPG-6, PEG-5, PEG-6, PEG-8, PEG-12, PEG-14, PEG-18, PEG-20, PEG-32, and mixtures thereof.

20. The composition of Claim 19 wherein the polyalkylene glycol is selected from the group consisting of PPG-4, PEG-8, PEG-12, PEG-20, and mixtures thereof.

21. The composition of Claim 16 wherein the non-aqueous liquid carrier is selected from the group consisting of C_1 - C_6 alkanols, carbitol, acetone, and mixtures thereof.

22. The composition of Claim 21 wherein the non-aqueous liquid carrier is a C_1 - C_6 alkanol selected from the group consisting of ethanol, n-propanol, isopropanol, n-butanol, amyl alcohol, and mixtures thereof.

23. The composition of Claim 16 wherein the composition further comprises a combination of the polyalkylene glycol and a polysaccharide styling polymer.

24. The composition of Claim 23 wherein the polysaccharide styling polymer is selected from the group consisting of glucosamine polysaccharide derivatives, cationic polysaccharides, anionic polysaccharides, and mixtures thereof.

25. The composition of Claim 16 wherein the composition further comprises a gelling agent.

26. A hair mousse hair styling composition comprising:

(a) from about 12% to about 90% by weight of a polyalkylene glycol styling agent that is substantially free of polyalkylene glyceryl ethers and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and

(b) from about 1% to about 88% by weight of a liquid carrier;

wherein after application and drying of the composition on dry hair the composition provides for a DRY HAIR INDEX of at least 242.

27. The composition of Claim 26 wherein the DRY HAIR INDEX is at least 266.

28. The composition of Claim 26 wherein the polyalkylene glycol is selected from the group consisting of ethoxy polyethylene/polypropylene glycol copolymers, methoxy polyethylene/polypropylene glycol copolymers, propoxy polyethylene/polypropylene glycol copolymers, butoxy polyethylene/polypropylene glycol copolymers, pentoxy polyethylene/polypropylene glycol copolymers, triglycerin, hexaglycerin, PPG-4, PPG-6, PEG-5, PEG-6, PEG-8, PEG-12, PEG-14, PEG-18, PEG-20, PEG-32, and mixtures thereof.
29. The composition of Claim 28 wherein the polyalkylene glycol is selected from the group consisting of PPG-4, PEG-8, PEG-12, PEG-20, and mixtures thereof.
30. The composition of Claim 26 wherein the liquid carrier is selected from the group consisting of water, C₁-C₆ alkanols, carbitol, acetone, and mixtures thereof.
31. The composition of Claim 30 wherein the liquid carrier comprises from about 40% to about 90% by weight of water and from about 1% to about 15% by weight of the C₁-C₆ alkanols.
32. The composition of Claim 31 wherein the C₁-C₆ alkanols are selected from the group consisting of ethanol, n-propanol, isopropanol, n-butanol, amyl alcohol, and mixtures thereof.
33. The composition of Claim 26 wherein the composition further comprises a combination of the polyalkylene glycol and a polysaccharide styling polymer.
34. The composition of Claim 33 wherein the polysaccharide styling polymer is selected from the group consisting of glucosamine polysaccharide derivatives, cationic polysaccharides, anionic polysaccharides, and mixtures thereof.
35. The composition of Claim 26 wherein the composition further comprises a gelling agent selected from the group consisting of crosslinked ethylene/maleic anhydride copolymers, crosslinked carboxylic acid polymers, hydrophobically modified nonionic cellulose polymers, and mixtures thereof.
36. The composition of Claim 26 wherein the composition further comprises a propellant selected from the group consisting of propane, butane, isobutane, nitrogen, carbon dioxide, nitrous oxide, atmospheric gas, 1,2-difluoroethane, dimethylether, and mixtures thereof.

37. A hair styling composition comprising:

- (a) from about 65% to about 99% by weight of a polyalkylene glycol that is substantially free of polyalkylene glyceryl ethers and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and
- (b) from about 1% to about 30% by weight of a liquid carrier;

wherein after application and drying of the composition on dry hair the composition provides for a DRY HAIR INDEX of at least 242.

38. The composition of Claim 37 wherein the polyalkylene glycol has a number average molecular weight of from about 400 to about 1500.

39. The composition of Claim 38 wherein the polyalkylene glycol is selected from the group consisting of ethoxy polyethylene/polypropylene glycol copolymers, methoxy polyethylene/polypropylene glycol copolymers, propoxy polyethylene/polypropylene glycol copolymers, butoxy polyethylene/polypropylene glycol copolymers, pentoxy polyethylene/polypropylene glycol copolymers, triglycerin, hexaglycerin, PPG-4, PPG-6, PEG-5, PEG-6, PEG-8, PEG-12, PEG-14, PEG-18, PEG-20, PEG-32, and mixtures thereof.

1. The first part of the document is a letter from the President of the United States to the Congress, dated January 1, 1861. It is a very important document, as it sets out the President's policy for the new year. The President states that he is pleased to see the Congress assembled, and that he is confident that the country is in a good position to meet the challenges of the future. He also mentions the recent election of Abraham Lincoln as President, and expresses his confidence in Lincoln's ability to lead the country.

2. The second part of the document is a report from the Secretary of the Treasury, dated January 1, 1861. It provides a detailed account of the financial state of the country at the beginning of the year. The report states that the country is in a sound financial position, with a strong and stable currency. It also mentions the recent increase in the national debt, and expresses the Secretary's confidence that the country will be able to manage the debt effectively.

3. The third part of the document is a report from the Secretary of the Interior, dated January 1, 1861. It provides a detailed account of the state of the country's natural resources, including land, minerals, and water. The report states that the country has a vast and rich supply of natural resources, and that the government is committed to managing these resources in a sustainable and responsible manner. It also mentions the recent discovery of gold in California, and expresses the Secretary's confidence that this discovery will have a positive impact on the country's economy.

4. The fourth part of the document is a report from the Secretary of the War, dated January 1, 1861. It provides a detailed account of the state of the country's military forces, including the Army and the Navy. The report states that the country has a strong and well-trained military, and that the government is committed to maintaining the military's readiness for any potential conflicts. It also mentions the recent increase in the size of the military, and expresses the Secretary's confidence that the country will be able to defend itself effectively.

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- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- Published:**
— *With international search report.*
— *Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.*
- (88) Date of publication of the international search report:
25 January 2001
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

WO 00/67709 A3

(54) Title: **HAIR STYLING COMPOSITIONS PROVIDING IMPROVED HAIR VOLUME AND HAIR HOLD PERFORMANCE**

(57) Abstract: Disclosed are hair styling compositions which provide improved hair volume and hair hold performance, and which provide for a DRY HAIR INDEX of at least 242 after application and drying of the compositions on dry hair. These hair styling compositions comprise from about 12 % to about 90 % by weight of a polyalkylene glycol styling agent that is substantially free of polyalkylene glyceryl ethers, and that has a number average molecular weight of from about 190 to about 1500 and from about 5 to about 35 repeating alkylene oxide radicals wherein each of the repeating alkylene oxide radicals has from 2 to 6 carbon atoms; and from about 1 % to about 88 % by weight of a liquid carrier which can be water, an organic solvent, or combinations thereof. Also disclosed are hair styling compositions in the form of pomades which provide improved hair volume and hair hold performance, and which comprise from about 65 % to about 99 % by weight of the select polyalkylene glycol styling agent, and from about 1 % to about 30 % by weight of a liquid carrier.

INTERNATIONAL SEARCH REPORT

Int lional Application No

PCT/US 00/03910

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61K7/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 841 060 A (WELLA AG) 13 May 1998 (1998-05-13) page 3, paragraph 1: claims 1,4,7 page 3, paragraph 7 page 3, paragraph 5 --- -/-	1,5, 7-10, 12-16, 19,21, 22,25, 26,28, 30-32, 35-39



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *&* document member of the same patent family

Date of the actual completion of the international search

26 September 2000

Date of mailing of the international search report

13/11/2000

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INTERNATIONAL SEARCH REPORT

Int lional Application No

PCT/US 00/03910

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	<p>DATABASE CHEMABS 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; TOUFUKUJI, RUKA: "Foam-forming aerosol-type hair-styling preparations" retrieved from STN Database accession no. 133:124919 CA XP002145878 abstract & JP 2000 204025 A (KOSEI CO., LTD., JAPAN) 25 July 2000 (2000-07-25)</p> <p>---</p>	<p>1,5,16, 18,19, 26,28, 37,39</p>
A	<p>US 5 002 075 A (MURPHY BETTY J ET AL) 26 March 1991 (1991-03-26)</p> <p>claims 1-3</p> <p>---</p>	<p>1,4,5, 7-9,16, 18,19, 21,22, 26,28, 30-32, 37,39</p>
A	<p>DATABASE CHEMABS 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; OOSAKI, ATSUSHI ET AL: "Hair cosmetic emulsions" retrieved from STN Database accession no. 129:8397 CA XP002145879 abstract & JP 10 139632 A (SUNSTAR K. K., JAPAN) 26 May 1998 (1998-05-26)</p> <p>---</p>	<p>1,5,16, 19,26, 28,37,39</p>
A	<p>DATABASE CHEMABS 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; HATANAKA, KENJI ET AL: "Hair wave-setting preparations containing diglycerin-polyoxypropylene adduct" retrieved from STN Database accession no. 125:176971 CA XP002145880 abstract & JP 08 165225 A (MIRUBON KK, JAPAN; SAKAMOTO YAKUHI KOGYO KK) 25 June 1996 (1996-06-25)</p> <p>---</p>	<p>1,5,16, 19,26, 28,37,39</p>

INTERNATIONAL SEARCH REPORT

Int. l. Application No
PCT/US 00/03910

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DATABASE CHEMABS 'Online! CHEMICAL ABSTRACTS SERVICE; COLUMBUS, OHIO, US; TAJIMA, MASARU ET AL: "Aqueous hair preparations containing polyoxypropylene diglyceryl ether an polyoxypropylene sugar ethers" retrieved from STN Database accession no. 117:97098 CA- XP002145881 abstract & JP 04 077414 A (LION K. K., JAPAN) 11 March 1992 (1992-03-11)</p>	<p>1,5,16, 19,26, 28,37,39</p>

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210.

Continuation of Box I.2

Claims Nos.: 1-39

Present claims 1-39 relate to a composition defined (inter alia) by reference to the following parameter: -dry hair index of at least 242. The use of these parameters in the present context is considered to lead to a lack of clarity within the meaning of Article 6 PCT. It is impossible to compare the parameters the applicant has chosen to employ with what is set out in the prior art. The lack of clarity is such as to render a meaningful complete search impossible. Consequently, the search has been performed without taking the above parameter into account with due regard to the general idea underlying the application.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/03910

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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